MEMORANDUM

To: John Scrabis, LANXESS Corporation
Kevin Boyle, LANXESS Corporation
Lisa Rushton, Womble Bond Dickinson

From: Nick Tang
Ted Bowie
Shari Libicki

Subject: Summary of Support Efforts Regarding HEM-3 Residual Risk Modeling for the LANXESS Facility in Charleston, SC

At the request of LANXESS Corporation (LANXESS), Ramboll US Corporation (Ramboll) has prepared this memorandum to summarize the work that we have completed pertaining to HEM-3 residual risk modeling of the LANXESS facility in Charleston, South Carolina ("Charleston Facility"), that is being conducted as part of the U.S. Environmental Protection Agency's (EPA's) risk and technology review (RTR) of the Miscellaneous Organic Chemicals Manufacturing National Emission Standards for Hazardous Air Pollutants ("MON NESHAP" or "MON").

BACKGROUND

Maximum Achievable Control Technology (MACT) requirements for MON-applicable sources were promulgated in 2003 (40 CFR Part 63, Subpart FFFF; National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing). As required by Section 112 of the Clean Air Act (CAA), EPA must examine MACT standards with respect to residual risk and technological advancements every eight years and promulgate revised MACT standards if the RTR indicates that changes are necessary. EPA published a draft of the proposed MON rule in the Federal Register on December 17, 2019 and specifically identifies the LANXESS Charleston Facility as having the highest category-specific cancer risk out of all facilities in the MON source category.

On behalf of LANXESS, Ramboll has conducted EPA-style residual risk modeling for MON-applicable sources at the Charleston Facility. The modeling included the following three different scenarios:

1. EPA Baseline Scenario

2. Updated Baseline Scenario

3. Updated Post-Control Scenario

The EPA Baseline Scenario uses the original model input files posted by EPA in the MON docket (EPA-HQ-OAR-2018-0746), while the Updated Baseline Scenario and Updated Post-Control Scenario use corrected inputs provided by LANXESS. LANXESS provided corrections to both the EPA Baseline Scenario as well as to EPA's Control Option 1 Scenario, which is further discussed in the proposed rule. The methodology LANXESS used in their corrections is outlined in a comment

1/4

letter submitted by LANXESS to the MON docket. This memorandum specifically outlines the risk modeling methodology and associated results.

RISK MODELING METHODOLOGY AND RESULTS

Modeling of the Charleston Facility under the EPA Baseline Scenario, Updated Baseline Scenario, and Updated Post-Control Scenario was performed to identify the magnitude of maximum cancer risk from inhalation exposure in areas representative of where people might be exposed. All modeling was conducted using the latest version of EPA's Human Exposure Model (HEM-3, version 1.55) with the following settings intended to match EPA's RTR risk assessment methods as closely as possible:

- HEM-3 was run with EPA's preferred air dispersion model, AERMOD, using the same version used by EPA for the MON risk assessment (version 18081).

- The model was run using a "default" dispersion environment, so HEM-3 chose the most appropriate environment (rural or urban). Based on the HEM-3 modeling files, an urban dispersion environment was selected.

- Deposition and depletion were not included in the model run.

- Building downwash was not included in the model run.

- Census information was obtained from 2010 data downloaded from EPA's HEM-3 website. All three scenarios were run using the most recent version of HEM-3 (version 1.55, updated on April 26, 2019).[1]

- Census blocks were modeled individually out to 3 kilometers. Consistent with EPA's standard approach for RTR risk assessments, these census blocks were represented by receptors located at the centroid of each census block. EPA occasionally includes "user receptors" around facilities when the default census block centroid locations do not adequately represent the locations where people live; however, EPA did not provide user receptors for their Baseline Scenario for the Charleston Facility, and Ramboll did not identify populated areas that were not adequately represented by the existing census block centroids, so user defined receptors were not evaluated in this analysis.

- Model-calculated receptor elevations were included based on surrounding census block elevations.

- The minimum distance allowed between a source and a receptor was set to the recommended value of 30 meters. At distances less than this minimum, receptors were considered to be on facility property.

- Emissions reflect "actual" emissions, as designated by EPA, for all Charleston Facility sources. Emissions for the EPA Baseline Scenario were obtained from the EPA MON docket (EPA-HQ-OAR-2018-0746). Specifically, category-specific emissions were obtained from "MON_Actual_HEMInput_HAPEmis_05212019.xlsx". The Updated Baseline Scenario included updates to emissions. The Updated Post-Control Scenario included updates to category-specific emissions for the EPA Control Option 1 Scenario, which were obtained from "MON_Actual_HEMInput_HAPEmis_05212019_opt1.xlsx". Emission inputs were held constant (i.e., not varied by time of day).

---

[1] EPA. *HEM Download Page*. Available online: https://www.epa.gov/fera/download-human-exposure-model-hem (accessed December 2019).

- The meteorological data used for the modeling was selected by HEM-3 from the library of model-ready files, which was downloaded from EPA's HEM-3 website.[2] HEM-3 selected surface and upper air data from Charleston International Airport, which is located approximately 6 miles northwest of the Charleston Facility.

- The modeling relied upon the most recent target organ endpoint library (Target_Organ_Endpoints.xls), which was downloaded from the HEM-3 website (updated on December 18, 2018).[3]

- Ramboll conducted six separate model runs for each revised scenario (Updated Baseline and Updated Post-Control) to estimate cancer maximum individual risk (MIR) with alternative unit risk estimates (UREs) for ethylene oxide. These alternative UREs are further discussed in comments submitted by the American Chemistry Council (ACC) under this MON rulemaking. The six different cases are listed below:

  - Case 1: uses the default dose response library (Dose_Response_Library.xls) available on the HEM-3 website (updated on December 18, 2018).[4], which uses an ethylene oxide URE of 5 x 10^{-3} per microgram per cubic meter ($\mu g/m^3$) consistent with EPA's Integrated Risk Information System (IRIS).

  - Case 2: uses an ethylene oxide URE of 2 x 10^{-3} per $\mu g/m^3$, which is a central estimate of the preferred EPA value rather than a 95th percentile estimate.

  - Case 3: uses an ethylene oxide URE of 1 x 10^{-3} per $\mu g/m^3$, which is the central estimate based on an alternative model for the URE.

  - Case 4: uses an ethylene oxide URE of 5 x 10^{-7} per $\mu g/m^3$, which is derived by Valdez-Flores et al. (2010).[5].

  - Case 5: uses an ethylene oxide URE of 1.4 x 10^{-6} per $\mu g/m^3$, developed by the Texas Commission of Environmental Quality (TCEQ).[6]

Maximum cancer risk estimates for the EPA Baseline, Updated Baseline, and Updated Post-Control Scenarios under all six cases are summarized below in Table 1.

---

[2] Ibid.

[3] Ibid.

[4] EPA. HEM Download Page. Available online: https://www.epa.gov/fera/download-human-exposure-model-hem (accessed December 2019).

[5] Valdez-Flores C, Sielken RL Jr, Teta MJ. 2010. Quantitative cancer risk assessment based on NIOSH and UCC epidemiological data for workers exposed to ethylene oxide. Regul Toxicol Pharmacol. Apr;56(3):312-20. doi: 10.1016/j.yrtph.2009.10.001.

[6] TCEQ. 2019. Ethylene Oxide Carcinogenic Dose-Response Assessment. CAS Registry Number: 75-21-8. Development Support Document. Proposed June 28, 2019. Available at https://www.tceq.texas.gov/assets/public/implementation/tox/dsd/proposed/eo.pdf

Table 1: Summary of Risk Modeling Results.[7]

Scenario	Category-Specific Cancer Maximum Individual Risk (MIR) (in a million)				
	EO IRIS URE	EPA EO URE (central estimate)	EPA EO URE (alternative model + central estimate)	Valdez-Flores URE	TCEQ URE
	5×10^{-3} per µg/m³	2×10^{-3} per µg/m³	1×10^{-3} per µg/m³	5×10^{-7} per µg/m³	1.4×10^{-6} per µg/m³
EPA Baseline	2,000	900	400	20	20
Updated Baseline	300	100	70	20	20
Updated Post-Control	100	50	30	20	20

CLOSING

The work conducted by Ramboll and described in this memorandum has resulted in improvements in the accuracy of data. Ensuring the accuracy of this data is critical, as data submitted can be used for a variety of purposes beyond the RTR of the MON standard. Improvements in the accuracy of the data provide greater confidence in the risk modeling results.

---

[7] Results have been rounded to one significant figure, consistent with EPA practice for RTR risk assessments.

4/4